[RAPID REVIEW]

Occupational therapy treatment protocols for cerebrovascular accidents: a rapid review of evidence

AUTHORS
Madri Engelbrecht[a]
https://orcid.org/0000-0002-4606-7572
Janke van der Walt[b]
https://orcid.org/0000-0001-5012-0121
Hester M. van Biljon[c]
http://orcid.org/0000-0003-4433-6457
Shaheed M. Soeker[d]
https://orcid.org/0000-0001-5382-1855

AFFILIATIONS
[a] Division of Disability and Rehabilitation Studies, Department of Global Health, Faculty of Medicine and Health Sciences, Stellenbosch University, South Africa
[b] Occupational Therapy Department, School of Health Sciences, Faculty of Medicine and Health Sciences, Stellenbosch University, South Africa
[c] Work-Link Vocational Rehabilitation Practice, Johannesburg, South Africa
[d] Occupational Therapy Department, University of the Western Cape, South Africa

CORRESPONDING AUTHOR
Madri Engelbrecht
Email: madrieng@sun.ac.za

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EDITOR
Pamela Gretschel
https://orcid.org/0000-0002-7890-3635

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ABSTRACT

Introduction: The rising prevalence of stroke in sub-Saharan Africa necessitates the exploration of the role of occupational therapy in rehabilitation of stroke. In the southern African country of South Africa, occupational therapy aligns with healthcare policies and laws, and this article presents a review of synthesized evidence of occupational therapy intervention in stroke care and rehabilitation.
Method: Rapid review methodology was used to develop a research question about cerebrovascular accident - intervention by occupational therapists., The Cochrane Library and MEDLINE databases were searched for relevant articles published between 2018 and 2023. Twenty four articles met the inclusion criteria and were analysed according to quantitative and qualitative parameters.
Results: Evidence of occupational therapy intervention with post-stroke upper limb impairment was found in 37,5% of articles. Occupational therapy for global improvement in function, cognitive rehabilitation, balance, social participation, work, and leisure comprised 45,8% of articles, and one article each reported evidence for occupational therapy addressing ADL and caregiver interventions.
Conclusion: Evidence from the past five years reflect diverse occupational therapy interventions with clients with stroke. Gaps in recent evidence remain in relation to context-specific interventions, especially from low- and middle-income countries.

Implications for practice
Occupational therapists adopt a holistic approach to stroke rehabilitation, tailoring interventions to address the multifaceted needs and goals of individual stroke survivors. The effectiveness of individualised, occupation-based approaches across various domains are highlighted.

- Therapists stay informed and up to date about emerging technologies and evidence-based practice to enhance their effectiveness in stroke rehabilitation.
- This review provides evidence of the prevalence of upper limb impairments post-stroke, which will enable therapists to be well-versed in the diverse intervention approaches for upper limb rehabilitation as outlined in the literature reviewed, including technologies like Brain Computer Interface, Mental Practice, Mirror Therapy, and Action Observation Therapy.
- Occupational therapy is vital in addressing cognitive impairments in stroke survivors, and practitioners can apply the evidence provided on interventions such as Virtual Reality and computer-assisted cognitive rehabilitation that have shown promise in improving cognition and ADL.

INTRODUCTION

Cerebrovascular accident (CVA) or stroke is increasing in sub-Saharan Africa and contributes to poverty in the region due to disabling sequelae in people of working age (18yr-65yr)[1,2,3]. Stroke is the second leading cause of death in the world[1,3], with most deaths occurring in low-income regions[2]. Occupational therapists as rehabilitation professionals intervene with stroke to address and remediate the effects of resultant impairment. Occupational therapy's focus in stroke rehabilitation is on the functional performance of day-to-day activities by persons injured by stroke. They use activities that are contextually relevant and meaningful to clients when focusing on a range of functions, including sensory and cognitive, that may be affected by stroke[4].

In South Africa, occupational therapy intervention for stroke is guided by laws and policies (for example, the National Health Act[5] and the Framework and Strategy for Disability and Rehabilitation services[6]) that enshrine the fundamental human right of all people to attain the highest standard of health as stated in the Bill of Rights in the South African Constitution[7]. Since 2012, a phased approach to the implementation of the National Health Insurance Policy was rolled out to promote universal health coverage and realise the equal right to health for all citizens [8]. Professional associations, such as the Occupational Therapy Association of South Africa (OTASA), were approached to describe and define their members' roles and practices within quality healthcare available to all who live in South Africa[9].

OTASA subsequently commissioned a task team to identify and compile practice evidence for occupational therapy services offered in various areas of healthcare, including the pertinent field of rehabilitation for CVA. The aim of this review was to synthesise evidence that describes occupational therapists' practice and intervention in CVA care and rehabilitation at all levels of care, and for all age groups.

METHODOLOGY

Rapid review methodology was selected to address the research aim through producing evidence in a resource-efficient manner[10]. This methodology enables accelerated knowledge synthesis, compared to traditional systematic review procedures, through the omission or streamlining of specific methods of producing evidence for stakeholders[10]. A rapid review approach enabled the researchers to produce high level evidence for decision-making in high priority, emergent, and contextual health questions[10]. The authors of this paper met weekly to ensure consistency and uniformity in approach and support. They are all occupational therapists with both clinical and academic experience, including in lecturing and clinical student supervision. Subject-specific expertise was obtained from one author with practice experience in CVA rehabilitation, and from the standard operating procedure for occupational therapy CVA intervention protocols document that was developed by a collective of expert therapists. The first author was the principal researcher for this review and was assisted by the other authors during all phases of the review.

The Department of Health's Method Guide for Rapid Reviews and Protocol Template for Rapid Reviews[11] were used to guide the review process, as well as the Cochran Rapid Reviews Method Guide[10]. The World Federation of Occupational Therapists' (WFOT) definition of occupational therapy was used to delineate the profession as a client-centred discipline that is concerned with the promotion of health and well-being through occupation[12]. The WFOT stipulates the primary goal of occupational therapy as enabling participation in activities of daily life by enhancing the ability of people and communities to engage in meaningful occupations[12]. OTASA's outline of where occupational therapists work, informed the levels of care to be considered in this review as primary, secondary, and tertiary care institutions[9]. Based on the same outline, practice across the lifespan of stroke survivors receiving occupational therapy was included in this review[9]. The definition of stroke referenced by the OTASA task team that developed the Stroke Rehabilitation Standard Operating Protocol for Occupational Therapy was used in this review, viz. "stroke is a clinically defined syndrome of acute, focal neurological deficit lasting more than 24 hours, attributed to vascular infarction, haemorrhage of the central nervous system"[13].

Setting the research question and topic refinement

The Cochrane Rapid Reviews Methods Group[10] suggests that a review question be defined with stakeholder involvement to ensure fit for purpose. As such, the research question for this review was set with due consideration of the OTASA Standards Protocol Group's work[13], as: *What CVA-related evidence exists for occupational therapy treatment protocols across the human life span?* The population of interest was defined as human beings of all ages, genders, and cultural groups who had sustained brain injury as a result of CVA and sought healthcare at settings at any level or care, and was referred for occupational therapy. Occupational therapy interventions were defined as per WFOT[12] and the OTASA[13] Standard Operating Protocol, and outcomes were considered as functional ability in the engagement of occupations after stroke.

Eligibility criteria

Only peer reviewed, full text articles of systematic reviews (Level 1 evidence[14]) that described occupational therapy decision making, skills, and intervention were considered for inclusion. Two databases, the Cochrane Library and MEDLINE, were searched for evidence. Initially, articles available in English that were published between 1 January 2012 and 31 March 2023 were included which generated a high number of articles. To accommodate the scope of rapid review methodology and timelines of the review, the date range of included articles was then changed to 1 January 2018 to 31 March 2023.

Searching

The two databases were searched with search terms and search strings developed by the authors in research team discussions, PIO (participants, intervention, outcome) term elements, and MeSH (Medical Subject Headings) terms were used:

"cerebrovascular accident or CVA or stroke" AND "occupational therapy or occupational therapist or occupational therapists or OT" AND "systematic review".

Grey literature and supplemental searching were not included. The search generated no systematic reviews that satisfied the eligibility criteria on the Cochrane database (n=0), and 143 articles (n=143) from the MEDLINE database. The PRISMA diagram[15] in Figure 1 (page 3) shows the results of the search, screen, and selection of articles.

Study Selection

The articles were imported to Rayyan et al.[16], a web tool to assist researchers with reviews and knowledge synthesis, to conduct screening and review (Figure, page 88). The first author screened the titles and abstracts of all articles (n=143) for inclusion, and the third author blindly screened 59 (41,3%) of the titles and abstracts (n=59). This author also screened all articles that were excluded by the first author (n=49). Two conflicts were identified after this level of screening and the second author resolved these through further screening.

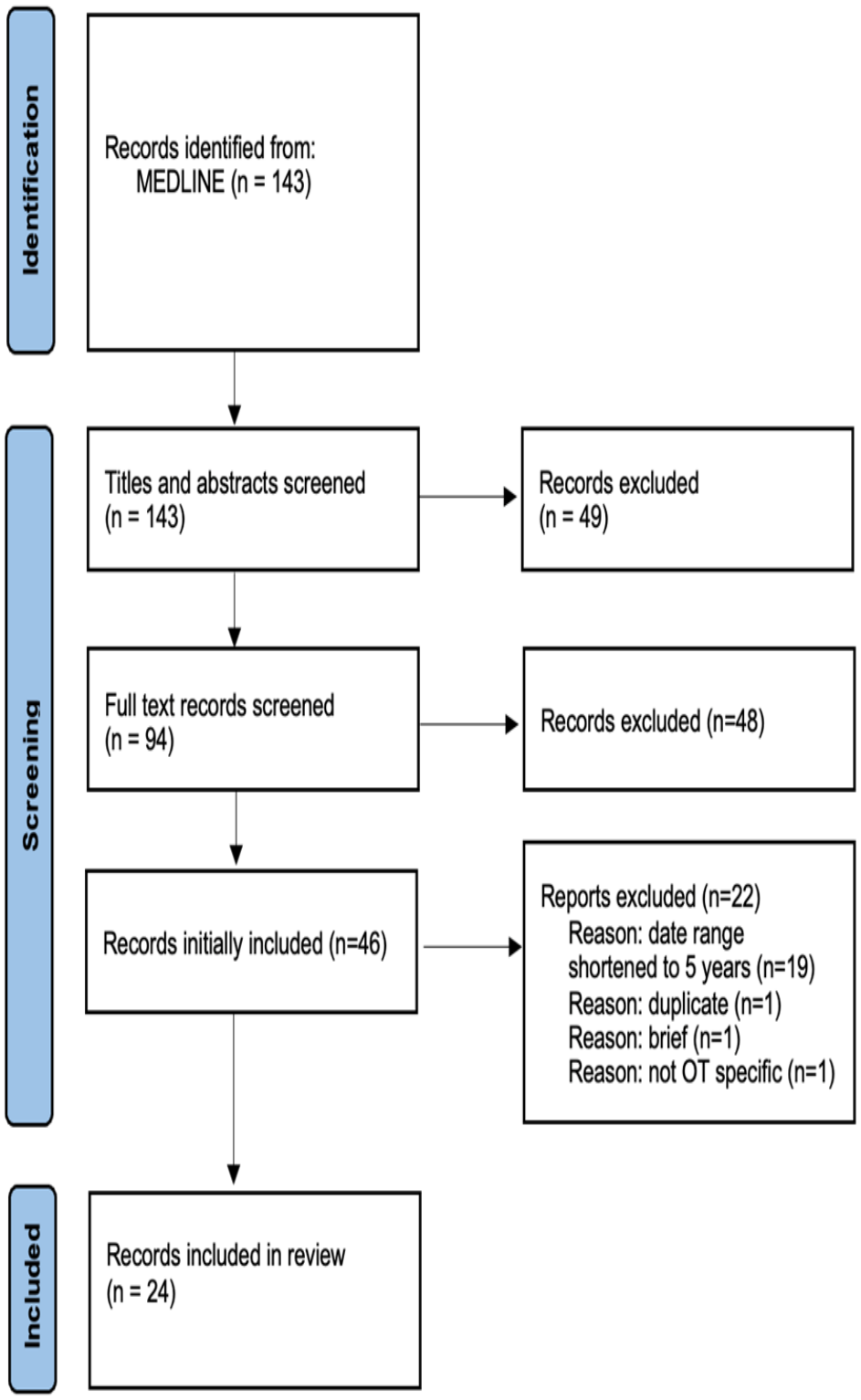

Figure 1: PRISMA diagram

Forty nine articles were excluded after the first level of screening. The first author then did full text screening of the remaining ninety-four articles (n=94), and excluded 48 articles (n=48) because they did not focus on occupational therapy, or were focused on an instrument or equipment rather than an intervention protocol, or did not report a systematic review, or reported on assessment rather than treatment. After full text screening a total of 46 articles were included for review (n=46). Due to the time and scope constraints of a rapid review and evidence of sufficient records available from 2018 to 2023, the time frame of articles included in this review was then further narrowed to the past five years. On this basis a further 22 articles were excluded - 19 that were published before 2018, one that was a duplicate, one that reported a brief of an included article, and one other that did not report on occupational therapy specific intervention. The final number of articles included for review was therefore 24 (n=24).

Risk of bias assessment, quality appraisal, and data extraction

The first author used the Critical Appraisal Skills Programme (CASP) appraisal tool for Systematic Review[17] to evaluate the quality of included articles. Table I (below) shows the quality scores given to articles according to the three answer options: Yes = 2, Can't tell = 1, and No = 0. The total score of each article was converted to be expressed as a percentage value. A higher percentage indicated a better quality article.

An Excel data extraction sheet (Table II. Page 90) was also developed to record quantitative and qualitative data extracted from articles for analysis. Data items that were extracted included participant characteristics, interventions, outcomes, and publication information.

Table I: Type of evidence and CASP rating of included articles.

Article	Type of evidence	CASP rating
Villa-Berges et al.[18]	Systematic review	100%
De Souza et al.[19]	Systematic review	100%
Kerr et al.[20]	Systematic review	80%
Dorsch et al.[21]	Systematic review	90%
Nogueira et al.[22]	Systematic review and meta-analysis	80%
Zhang et al.[23]	Systematic review and meta-analysis	70%
Turville et al.[24]	Systematic review	80%
Barclay et al.[25]	Intervention review	90%
Bai et al.[26]	Systematic review and meta-analysis	70%
Mohammadi et al.[27]	Systematic review and meta-analysis	80%
Green et al.[28]	Systematic review	80%
Mack and Hildebrand[29]	Narrative synthesis systematic review	90%
Gibson et al.[30]	Systematic review	80%
Chen et al.[31]	Systematic review	80%
Nie et al.[32]	Systematic review	80%
Proffitt et al.[33]	Systematic review	90%
Lee et al.[34]	Systematic review	80%
Stewart et al.[35]	Systematic review	80%
Sarfo et al.[36]	Systematic review	60%
Rodríguez-Martínez et al.[37]	Systematic review	60%
McGlinchey et al.[38]	Systematic review	70%
Díaz-Arribas et al.[39]	Systematic review	80%
Peng et al.[40]	Systematic review	80%
Khan et al.[41]	Review of systematic reviews	60%

Synthesis

Quantitative data underwent analysis using Excel. Frequency of treatment protocols described in articles were counted and grouped, and percentages were used to derive meaningful insights. Concurrently, qualitative data were examined for textual elements. Weekly group discussion were held to share and deliberate on the outcomes of analyses, and to address emerging patterns of discrepancies. The first author integrated the insights gleaned from analyses into a coherent whole to synthesise the discussion and conclusions of findings.

Table II: Articles included in the review

Post-stroke focus area	Authors & Publication	Title	Study population	Intervention	Findings
Upper limb	Villa-Berges et al., 2023[18] Occupational Therapy International	Motor Imagery and Mental Practice in the Subacute and Chronic Phases in Upper Limb Rehabilitation after Stroke: A Systematic Review	Clients diagnosed with stroke and upper limb affected, with MI or MP as the only or combined modality, in sub-acute and chronic phases	• Therapist-supervised MI or MP • Conventional PT and/or OT (stretching exercises, NDT, techniques to enhance independent ADL)	MI and/or MP treatment in subacute and chronic phases combined with traditional treatment is more effective in UL motor recovery than intervention with only conventional treatment
	De Souza et al., 2021[19] Occupational Therapy International	Protocols used by occupational therapists on shoulder pain after stroke: systematic review and meta-analysis	Populations that had stroke and sequelae of shoulder pain	Interventions with equipment or resources associated with exercise and functional activities to treat shoulder pain: • TENS • t-NMES • FES-BCI • therapeutic taping • dry needling	• Meta-analysis indicated pain reduction with the main protocols used in shoulder pain, i.e. electrical stimulation (with or without control by brain-machine interface), therapeutic taping, and dry needling. • UL function and ROM are favoured by these treatments.
	Kerr et al., 2020[20] American Journal of Occupational Therapy	Stretching and Splinting Interventions for Poststroke Spasticity, Hand Function, and Functional Tasks: A Systematic Review	≥ 18 yrs with chronic stroke (≥ 6mths) with PSS (poststroke spasticity)	UL stretching and splinting interventions: static and dynamic splinting, manual stretching, stretching devices	Low to moderate strength evidence for effectiveness of stretching interventions aimed at reducing spasticity, increasing hand function, and improving engagement in functional tasks for adults with post-stroke spasticity
	Dorsch et al., 2023[21] Journal of Physiotherapy	Bobath therapy is inferior to task-specific training and not superior to other interventions in improving arm activity and arm strength outcomes after stroke: a systematic review	Adults (ave 49 yrs - 73 yrs) after stroke; ranging < 6 months (acute/subacute) to 4,5 years post-stroke	Therapy based on the Bobath concept, targeting affected UL; compared with different interventions, i.e. general arm movements, task-specific training, robotics, mental practice, or no intervention	• Task-specific training and robotics resulted in improved arm outcomes for stroke when compared with Bobath therapy; • Task-specific training is also superior to Bobath therapy for arm activity and strength outcomes
	Nogueira et al., 2021[22] Brain Research Bulletin	Mirror therapy in upper limb motor recovery and activities of daily living, and its neural correlates in stroke individuals: A systematic review and meta-analysis	Mean age of 59.1 yrs; 8.5 days post-stroke to 4.76 yrs poststroke	Mirror therapy	• MT contributes to improvements in motor and sensory functions, especially compared to standard protocols; • Also showed small benefit (compared to sham therapy) to motor and functional recovery outcome and ADLs
	Zhang et al., 2019[23] PLOS ONE	The effects of action observation training on improving upper limb motor	Participants who had CVA between < 1month ago to > 6 months ago	Task-based AOT or movement-based AOT	• AOT had a significant effect on UL motor functions immediately after intervention; • Task-based AOT may be more effective than movement-based AOT

		functions in people with stroke: A systematic review and meta-analysis			
	Turville et al., 2019[24] Clinical Rehabilitation	The effectiveness of somatosensory retraining for improving sensory function in the arm following stroke: a systematic review	199 stroke survivors; ave age = 59.5; ave 1.8 yrs post-stroke (ranged 3 wks to 6.2 yrs); > male participants; almost equal R- and L-sided stroke	Retraining somato-sensation or combined somatosensory and motor retraining	• Somatosensory discrimination retraining may improve stroke survivors' ability to discriminate bodily sensations in the arm and hand; • Limited evidence for somatosensory discrimination retraining facilitating arm function
	Barclay et al., 2020[25] Cochrane Database of Systematic Reviews	Mental practice for treating upper extremity deficits in individuals with hemiparesis after stroke.	Individuals with hemiparesis after stroke; in settings - clinic, home, research laboratory, or unclear	MP of UL movement or tasks in addition to other treatment or standalone	• Moderate-certainty evidence shows that MP with other treatment appears more effective in improving UL activity than the other treatment alone; • Also beneficial in improving UL impairment; • ADLs may not be improved with MP in addition to other treatment
	Bai et al., 2020[26] Journal of NeuroEngineering and Rehabilitation	Immediate and long-term effects of BCI-based rehabilitation of the upper extremity after stroke: a systematic review and meta-analysis.	Persons with hemiparesis after stroke; mean age range 40.94 - 67.1 yrs	BCI-orthosis, -exoskeletan, - visual feedback or somatosensory feedback, - robot, conventional rehabilitation and visual feedback, standard training and orthosis, -FES, and other	• BCI training is safe after stroke and had significant immediate effects on improvement of upper extremity motor function; • BCI seem more effective than MI-based BCI; • FES may be more useful device triggered by BCI for functional recovery than other kinds of neural feedback
Balance	Mohammadi et al., 2019[27] Journal of Stroke and Cerebrovascular Diseases	Effects of Virtual Reality Compared to Conventional Therapy on Balance Poststroke: A Systematic Review and Meta-Analysis	Mean ages ranged 51.96 yrs - 64.85; poststroke periods ranged recent (>15 days) - chronic (>6 months)	• VR and conventional therapy	VR combined with conventional therapy is moderately more effective in improving balance than conventional therapy alone in post-stroke individuals.
	Green et al., 2019[28] American Journal of Occupational Therapy	Systematic Review of Yoga and Balance: Effect on Adults With Neuromuscular Impairment	Community-dwelling persons post-stroke	Yoga-based intervention (beginner yoga group sessions, and yoga group sessions)	Yoga has potential as an effective modality in occupational therapy intervention to improve balance post-stroke, and to reduce risk of falls in community-dwelling older persons with stroke
Caregivers	Mack and Hildebrand, 2023[29] American Journal of Occupational Therapy	Interventions for Caregivers of People Who Have Had a Stroke: A Systematic Review	Adult caregivers (>18y) of someone with stroke	• CBT techniques • Caregiver education only • Caregiver support only • Education and support • Multimodal interventions	• OT has a role in helping caregivers maintain participation in caregiving. • Problem-solving interventions, CBT, education and training, and support interventions (or a combination of approaches) should be used by OTs • Intervention should be provided before discharge, in person in health care settings, in the home, and remotely

Cognition	Gibson et al., 2022[30] Cochrane Database of Systematic Reviews	Occupational therapy for cognitive impairment in stroke patients.	Adults with clinical stroke & confirmed cognitive impairment; • ages 43 – 81 yrs; • 1142 participants; • 2 wks to 8 yrs since stroke; • in hospital/rehab centre/out-pts	Remediation approaches: • CBI • pen and paper materials Compensatory and adaptive approaches: • ADL strategy training • ADL GUIDE training • Home Automation training • Dressing training	• Effectiveness of OT for cognitive impairment post-stroke is unclear • Little to no clinical difference in BADL immediately after intervention and at 3- and 6-months follow-up • Slight improvement in global cognitive performance of clinically important difference immediately after intervention
	Chen et al., 2022[31] Archives of Physical Medicine and Rehabilitation	Effects of Virtual Reality Rehabilitation Training on Cognitive Function and Activities of Daily Living of Patients With Poststroke Cognitive Impairment: A Systematic Review and Meta-Analysis	35y - 85y; in-hospital	Conventional therapies (rehabilitation therapy; drug therapy) and VR training	• VR training improved cognitive function and ADL in post-stroke cognitive impairment and ADL • VR rehabilitation training can be widely used in clinical rehabilitation as complementary strategy to conventional cognitive rehabilitation
	Nie et al., 2022[32] Journal of Clinical Nursing	The effects of computer-assisted cognitive rehabilitation on cognitive impairment after stroke: A systematic review and meta-analysis	18 yrs – 85 yrs	Computer-assisted cognitive rehabilitation, incl. • Rehacom software • Brain Train System • Individually tailored computer-aided programs	Computer-assisted cognitive rehabilitation added to conventional therapy significantly improved global cognition and ADL of patients with post-stroke cognitive impairment
Social participation, work, leisure	Proffitt et al., 2022[33] American Journal of Occupational Therapy	Interventions to Improve Social Participation, Work, and Leisure among Adults Poststroke: A Systematic Review	Post-stroke (or caregiver), ≥ 18 yr	• Occupation-based approaches, metacognitive strategy training • Education and training approaches • Impairment-based approaches • Enriched environment approaches	• There is low strength evidence for occupation-based and problem-solving approaches • Moderate evidence for group-based approaches
	Lee et al., 2019[34] Archives of Physical Medicine and Rehabilitation	Content and Effectiveness of Interventions Focusing on Community Participation Poststroke: A Systematic Review	Mean age range 46-73 yrs; mean time post-stroke ranged 80 days - 7 yrs;	• Leisure participation and community integration in community or hospital; • delivered in one-on-on format or groups, or combined; • for 6 weeks to 12 months	• Limited positive effects on participation, depression and health-related quality of life • Community participation-focused interventions seem to have a promising effect on these outcomes when interventions were individualised and aimed to empower people with tools to manage community participation

ADL	Stewart et al., 2018[35] PLOS ONE	Non-pharmacological interventions for the improvement of post-stroke activities of daily living and disability amongst older stroke survivors: A systematic review	≥ 65y or mean age must be ≥ 65y	Various in-hospital and home-based interventions	• Some evidence shows that additional OT can benefit older stroke survivors' ADL • No evidence suggested that additional OT can improve post-stroke disability
Global	Sarfo et al., 2018[36] Journal of Stroke and Cerebrovascular Disease	Tele-Rehabilitation after Stroke: An Updated Systematic Review of the Literature	Not specified	Interventions for different impairments: • Motor rehabilitation (hemiparesis and UL limitations) • Interventions for ankle disability • Guttman Neuro Personal Trainer cognitive tele-rehabilitation (higher cortical dysfunction) • Intervention for depression	Tele-rehabilitation for motor and high cortical deficits and post-stroke depression appears as effective as in-person therapies, if not better
	Rodríguez-Martínez et al., 2021[37] International Journal of Environmental Research and Public Health	Evidence of Animal-Assisted Therapy in Neurological Diseases in Adults: A Systematic Review	Clients with stroke	Animal-assisted therapy (AAT) with horses: • grooming and equipping horse • equestrian activity • balance exercises • trunk rotation exercises • exercises to train affected parts • cognitive exercises • strength exercises • relaxation • body awareness • deep, slow breathing	• Significant results in perception of recovery up to 6 months after intervention; • Improved QoL in caregivers after intervention up to 3 months later; • Effectiveness in improving gait and functional mobility observed
	McGlinchey et al., 2020[38] British Medical Journal	The effect of rehabilitation interventions on physical function and immobility-related complications in severe stroke: a systematic review	Patients with severe stroke - ≥ 18 yrs; mean age 72.7 yrs	Non-surgical or non-pharmacological interventions used in current clinical practice as part of usual rehabilitation care after stroke, to manage problems relating to physical function or immobility-related complications	• Very early mobilisation and OT in care homes were no more effective than usual care • Wrist and finger NMES improve wrist extensor and grip strength • Additional UL and LL training improves UL and LL function respectively • Improvement in independent ADL and gait, and gait speed

	Díaz-Arribas et al., 2020[39]
	
	Disability and Rehabilitation
		Effectiveness of the Bobath concept in the treatment of stroke: a systematic review.	Adults with stroke	• PNF compared with Bobath compared with conventional treatment:
				  ○ traditional exercises
				  ○ functional activities
				• NDT compared with robot-assisted therapy
					• Constraint-induced therapy shows greater effectiveness in UL treatment/rehabilitation than Bobath therapy
					• UL training shows greater effectiveness than conventional therapy (incl. Bobath concept)
					• Multimodal interventions and treatments where Bobath is used are more effective combined with intensive therapy for UL

				• Constraint-induced movement therapy compared to NDT • Standardised dose-matched NDT exercises compared to BATRAC • Bobath compared to orthopaedic approach • Arm BASIS training	
	Peng et al., 2019[40] Clinical Rehabilitation	Action observation therapy for improving arm function, walking ability, and daily activity performance after stroke: a systematic review and meta-analysis.	600 clients; mean age 48.65 to 78.8 yr; mean stroke onset time varied 17.8 to 1472.9 days	Clients asked to watch video of arm and hand ROM exercises, reaching and grasping movements, walking on different surfaces	Moderate to large effects sizes on improving arm and hand motor function, walking ability (acute/subacute/chronic phases), gait velocity, and daily activity performance compared with control treatments
	Khan et al., 2019[41] Annals of Physical and Rehabilitation Medicine	Non-pharmacological interventions for spasticity in adults: An overview of systematic reviews.	Not specified	• Acupuncture (incl. electro-acupuncture) • Electrical stimulation • Multidisciplinary rehabilitation after BoNT injections	• Electro-acupuncture combined with conventional routine care reduce spasticity, improve overall motor functions and ADL • NES combined with other interventions improve spasticity and joint ROM • Some evidence for rehabilitation programs targeting spasticity (e.g. mCIMT, stretching, dynamic elbow splinting and OT)

BCI=brain-computer interface; UL=upper limb; MI=mental imagery; FES=functional electrical stimulation; MP=mental practice; MT=mirror therapy; ADL=activities of daily living/life; AOT=action observation training; ROM=range of movement; AAT=animal assisted therapy; QoL=quality of life; NMES=neuromuscular electrical stimulation; BoNT=botulinum toxin-A; VR=virtual reality; CBT=cognitive behavioural therapy

Reporting of results

The preliminary results of this review were presented to stakeholders at an online OTASA webinar during May 2023. These were member and non-member occupational therapists of the Association from different fields of clinical and non-clinical practice (for example, academia), and OTASA management. Two hundred and seventy four attendees were present and were encouraged to participate in discussion, feedback, and questions. The webinar engagement was used to refine the discussion and conclusions in this article.

RESULTS

Twenty-four systematic reviews were included for analysis in this review (Table I page 89). Occupational therapy for upper limb impairment after stroke was reported by the largest proportion of articles (n=9; 37,5%), followed by articles that reported occupational therapy for global improvement in function (n=6; 25%). Three articles (12,5%) focussed on cognitive interventions, and two articles (8,3%) reported occupational therapy to address balance, and leisure, social participation and work grouped together. One article (n=1; 2,4%) reported interventions for improvement of ADL generally, and another on interventions with caregivers of stroke survivors.

Occupational therapy rehabilitation for upper limb after stroke

Populations of clients who received upper limb rehabilitation after stroke included adults (>18 years) with upper limb impairment up until the age of 73 years, and their recovery spanned acute (8.5 days post-stroke) to chronic (6.2 years post-stroke) stages. Only one article reported intervention settings clearly as either at a clinic, at a client's home, or in a research laboratory[25]. Other articles were not specific about where intervention took place.

One article did not specify if the protocol under scrutiny was offered by an occupational therapist or another rehabilitation professional, but the authors included occupational therapists. These authors reported on the use of brain-computer interface (BCI) technology in post-stroke upper limb (UL) interventions by occupational therapists[26]. The researchers confirmed that BCI in combination with traditional treatment, to treat UL motor impairment and motor activity after stroke. Nogueira et al.[22] also found that mirror therapy (MT) is used in occupational therapy to improve UL motor and sensory functions as well as in motor and functional recovery outcomes and activities of daily living (ADL).

Action Observation Training (AOT) was reported to be used by occupational therapists with significant effect on UL motor function improvement after stroke, with task-based AOT being more effective than movement-based AOT[23]. Occupational therapists further retrain somatosensory components of the UL to improve sensory discrimination in the arm and hand of stroke survivors[24].

De Souza et al.[19] reviewed evidence for the use of electrical stimulation, dry needling, and therapeutic taping, as the primary occupational therapy protocols used to reduce shoulder pain after stroke. The authors found that these protocols deliver related positive outcomes for upper limb function and range of movement (ROM). One article reviewed intervention for post-stroke upper limb spasticity and found that occupational therapists use stretching interventions with static and dynamic splints, passive and active manual stretching and passive stretching devices, for example, resting hand splints, effectively to reduce spasticity, increase hand function, and to improve engagement in functional tasks[20].

A review by Dorsch et al.[21] concluded that task-specific training and robotics are used by occupational therapists to improve upper limb activity and strength with greater success than with Bobath therapy.

Occupational therapy interventions for global improvement after stroke

Seven articles reported reviews on occupational therapy interventions that address the global functioning of clients after stroke, ranging from interventions for post-stroke UL limitations, mobility functions, and balance, to interventions for daily activity performance. One article reported and updated systematic review of evidence for tele-rehabilitation[36], while the rest of the articles reported on face-to-face or in-person interventions[37,38,41,39]. Sarfo and colleagues[36] reviewed tele-rehabilitation for persons with stroke injury that is used by rehabilitation therapists (including

occupational therapists). Therapists offered motor rehabilitation for hemiparesis and UL limitations, interventions for ankle disability, cognitive rehabilitation, and depression through tele-media such as telephones and videoconferencing. The review concluded that tele-rehabilitation was effective in treating motor and high cortical deficits, as well as depression post-stroke.

Rodríguez-Martínez et al.[37] systematically reviewed evidence about animal-assisted therapy (AAT) with dogs and horses to inform activity-based occupational therapy practice for clients with stroke. They evidenced that AAT significantly improved clients' perception of recovery up to six months after intervention, that the quality of life (QoL) of caregivers improved up to three months after intervention, and that clients' gait and functional mobility effectively improved.

Two articles, one systematic review and one overview of systematic reviews, focused on non-pharmacological interventions aimed at relieving spasticity and immobility-related complications along with physical function after severe stroke. McGlinchey and colleagues[38] concluded that very early mobilisation and occupational therapy after severe stroke in care homes were no more effective than usual post-stroke care for the improvement of physical function and immobility-related complications. An improvement was found in independent instrumental ADL (those ADL that enable the individual to live independently in their community), gait, and gait speed, however, only when additional upper and lower limb training were offered to usual rehabilitation care. Additional wrist and finger Neuromuscular Electrical Stimulation (NMES) in conjunction with usual care also brought about improvement in wrist extensor and grip strength, but not necessarily in ADL performance. Khan et al[41] considered the effectiveness of occupational therapy with dynamic elbow extension splinting as part of multidisciplinary rehabilitation that follows post-stroke Botulinum Toxin-A (BoNT) injections. They concluded that very low quality evidence suggests that dynamic elbow splinting and occupational therapy can improve elbow range of motion after stroke.

One article considered the effectiveness of the Bobath concept in post-stroke rehabilitation, compared to conventional treatments such as functional activities and orthopaedic approaches that promote compensation of lost function[39]. They found that training via forced use of an affected upper limb (with/without the use of robotic aids, and with/without restriction of movement of the non-affected upper limb) was more effective in addressing motor control and upper limb dexterity compared to the Bobath concept. The authors further concluded that the Bobath concept did not prove to be superior in treatment of post-stroke balance disorders[39].

A final article reported moderate to large effect sizes on the use of AOT after stroke to improve arm and hand motor function, gait velocity, walking ability, and daily activity performance, when compared with conventional occupational therapy[40].

Occupational therapy intervention for cognitive impairment after stroke

Three articles reported occupational therapy intervention focused on improving cognitive impairment as a result of stroke[31,32,30]. These included two systematic reviews that reported promising findings about the use of computer-based activities used in combination with conventional cognitive rehabilitation. Chen et al.[31] reviewed the use of Virtual Reality (VR) together with conventional rehabilitation therapy and the effect thereof on cognitive function and ADL in stroke survivors between 34 and 86 years of age. Their review concluded that the combination of VR training and conventional rehabilitation resulted in improved cognition and ADL outcomes for this population, and that VR rehabilitation training can be used widely as complementary to conventional cognitive rehabilitation. Nie et al.[32] reviewed the effects of various software packages and computer-based cognitive training systems on cognitive impairment after stroke, and found that 18 to 85-year old clients with cognitive impairment due to stroke, showed significant improvement in ADL and global cognition when computer-assistive cognitive rehabilitation is added to conventional therapy.

One article reviewed remediation approaches (e.g. using pen and paper materials) and compensatory and adaptive approaches (e.g. ADL strategy training) used by occupational therapists with stroke patients with cognitive impairment[30]. They found that these interventions resulted in little to no clinical difference in the performance of basic ADL (BADL), and a slight improvement in global cognitive performance. There was, however, no clear effectiveness of occupational therapy for cognitive impairment after stroke identified.

Occupational therapy post-stroke interventions for balance

Two systematic reviews considered post-stroke interventions done by rehabilitation professionals to address balance impairment. Mohammadi et al.[27] reviewed studies where VR was used in combination with conventional rehabilitation (stretching, range of motion, therapeutic exercises, strengthening, FES, neurodevelopmental treatment, gait and balance training, and functional activities) with persons ranging in mean ages from 51.96 to 64.85 years. Periods of post-stroke were from recent (>15 days) to chronic stages (>6 months). VR training included the use of speakers, monitors, and static or dynamic balance training surfaces or floor space (i.e. non-immersive systems). The reviewers' main finding was that VR, when combined with conventional therapy, was moderately more effective in improving balance in post-stroke individuals.

The second review focused on the use of yoga in addressing balance with adults with neuromuscular impairment as a result of various conditions, including stroke[28]. The population of interest was older persons who lived in the community and the aim of the review included ascertaining whether yoga for balance affected risk of falls. Yoga-based intervention comprised beginner yoga group sessions, and yoga group sessions. The latter, which was offered twice a week for eight weeks, resulted in significantly improved balance baseline scores for individuals. The review concluded that occupational therapists can use yoga as an effective modality to improve balance in people with stroke.

Occupational therapy with caregivers of persons with stroke

One review addressed the role of occupational therapists in supporting and enabling caregivers of persons with stroke. Mack and Hildebrand[29] systematically reviewed studies focused on interventions with adult caregivers (>18 years) of persons with stroke. Reviews considered the use of caregiver education and support, Cognitive Behavioural Techniques (CBT), and multimodal interventions with this group. They concluded that occupational therapists have a role in enabling caregivers to maintain participation in the occupation of caregiving. The review further found that CBT, problem-solving interventions, education, training, and support interventions (or these approaches in combination) should be offered to caregivers before discharge of the person with stroke. These could, alternatively, be offered in person in health care settings, in the home, or even remotely.

Occupational therapy to improve work, social participation, and leisure after stroke

Two systematic reviews reported occupational therapy interventions for the occupational categories of social participation, work, and leisure. Proffitt and colleagues[33] included studies that focused on persons with stroke or caregivers that were 18 years and older. These studies reported on metacognitive strategy training, occupation-based approaches, impairment-based approaches, education and training approaches, and enriched environment approaches used in occupational therapy with stroke clients. For each approach, a number of intervention aspects were reported,

specifically: individual-focused problem-solving, cognitive orientation to daily occupational performance, group-based interventions, client education, community-based with follow-up, caregiver education, upper extremity training, cognitive training, visual scanning training, individual exercise and balance training, group intervention, work, and leisure. Their review concluded that improvement in the social participation, social functioning, or social roles of post-stroke clients, were found in primarily occupation-based studies. According to their quality rating used in the review, strength of evidence for problem-solving approaches and occupation-based were low while evidence for group-based approaches was of moderate strength.

Lee et al.[34] reported studies done with persons of mean ages 46 to 73 years who sustained stroke from 80 days up until 7 years later, and reviewed the content and effectiveness of interventions that were focused on community participation for this population. They considered occupational therapy interventions in both community and hospital settings that were delivered in individual, group, or combined formats, over periods of six weeks to 12 months. Interventions that prioritised community participation, coupled with individualised approaches to empower people with tools for management of their participation, yielded promising effects on health-related quality of life, participation, and depression.

Occupational therapy intervention for ADL

The involvement of occupational therapy as non-pharmacological intervention after stroke to improve activities of daily living was considered in one systematic review. The review focused on older stroke survivors (older than 65 years or mean age > 65 years) and included 12 randomised control trials with a wide range of occupational therapy interventions[35]. These interventions included group-based assistive device demonstrations in hospital and additional home-based training, facilitating more independence in ADL and return to function, and the teaching of new skills. Further interventions were to enable the use of the supplied equipment, giving information to participants as well as carers, referring to or liaising with other agencies, and strategy training to compensate for apraxia during ADL performance. Occupational therapy that was provided quicker and more often, and home visits with individual goals for self-care were, furthermore, reported in the review. Other occupational therapy interventions involved participation in domestic and leisure activities, addressing outdoor mobility goals, and leisure activity focused interventions. The review concluded that evidence suggests benefit to older stroke survivors' ADL performance with occupational therapy sessions offered additionally to usual occupational therapy intervention. However, one approach is not evidently more beneficial than another. They further surmised that ADL focused therapy is important in stroke rehabilitation, although optimal intensity and/or duration of intervention have not been determined yet.

Ethical considerations

Ethical clearance was not required for this review as no primary data collection was done. The quality and bias of selected articles were tested to ensure quality results to inform the question of this review.

DISCUSSION

Articles included in this review report provided an overview of occupational therapy interventions for stroke survivors that were recorded and published over the past five years (2018 - 2023). One article offered a review of 18 other systematic reviews41, while the rest of the articles (n=23) reported systematic reviews completed by the authors of these articles. Included articles satisfied the lead author's assessment of risk of bias and quality in a range from 60% to 100%. A comprehensive overview of the various occupational therapy interventions for stroke survivors were reported that covers a range of domains including upper limb rehabilitation, global functioning, cognitive impairment, balance, caregiver support, social participation, work, leisure, and ADL. These were considered only in terms of persons 18 years and older receiving post-stroke occupational therapy, and, therefore, excluded clients from 13 months of age until 17 years old[13]. The higher prevalence of stroke in adult and older life stages may explain the focus of reviewed articles reflected over the past five years. Nevertheless, review findings demonstrate the wide variety of occupational therapy interventions available for stroke survivors that reflect the multifaceted nature of stroke recovery and are tailored to address specific impairments and needs of individuals.

Further reported evidence reflect a lack of focus on occupational therapy's role in vocational rehabilitation and return to work13 or reviews of occupational therapy for driving post-stroke as an aspect of mobility.

No studies in this review (with the exception of one that focused on improvement in ADL[35]), specified the settings within which post-stroke occupational therapy was offered, although inference was possible from reports on the stages of recovery as acute to chronic. Such lack of reporting may be significant in the context of local service provision with a primary healthcare and community-based rehabilitation focus, if evidence for the profession is rendered primarily from high income countries with different healthcare settings, approaches and priorities.

Findings from this review indicate an emphasis on occupational therapy interventions for upper limb impairments, suggesting the profession's focus on the specific challenges associated with stroke. The array of intervention approaches reported to treat post-stroke UL impairment, illustrates occupational therapy's potential for innovative practice and the use of new methods and technologies, such as BCI and VR. Other innovative rehabilitative approaches, including the use of tele-rehabilitation in the treatment of motor deficits and cognitive impairments, illustrate the profession's alignment with global trends of integrating technology with healthcare services to overcome geographical and accessibility barriers. The role and utilisation of technology in stroke rehabilitation continued to present throughout the literature on occupational therapy approaches to cognitive rehabilitation and interventions to improve balance after stroke. In the context of South Africa's under-resourced public health system, the availability, access to, and use of technology by South African occupational therapists in stroke rehabilitation requires consideration if rehabilitative interventions were to benefit local clients optimally.

Caregivers of stroke survivors also benefit from occupational therapy intervention. Providing caregivers with CBT techniques, education, training, and support can help them cope with the challenges of caregiving and in maintaining their own well-being. Occupational therapy interventions further extend beyond physical rehabilitation to promote social participation, work, and leisure activities. Individualised, occupation-based approaches were found to be somewhat effective, emphasising the importance of tailoring interventions to the individual's needs and goals.

Occupational therapy interventions targeted at improving ADL performance in older stroke survivors were shown to be beneficial. The review highlighted the diversity of intervention approaches, suggesting that a personalised approach may be more effective.

While this review provides valuable insights into the effectiveness of various occupational therapy interventions, it also identifies areas where further research is needed. Our review underscores the pressing need for contextually relevant studies utilising experimental designs, particularly in South African context, where there was a notable scarcity of research contributions within the scope of the review. Future studies should aim to clarify the optimal intensity and duration of interventions, determine long-term outcomes, and explore the cost-effectiveness of these approaches. Of interest would, furthermore, be the level of training, skills and

experience of therapists offering sophisticated stroke rehabilitation in South Africa.

The findings from this review imply that occupational therapists should consider a holistic approach and tailor interventions to the specific needs of stroke survivors. Additionally, in the advent of emerging technological approaches therapists should stay informed about technologies and evidence-based practices to promote their effectiveness in stroke rehabilitation.

Limitations

The scope of this review did not include assessment protocols, methods, and instruments/tools used by occupational therapist in post-stroke care.

No articles reported occupational therapy intervention with post-stroke oedema in particular, while prevention and intervention for clients with swelling in extremities after stroke are included in South African protocols of occupational therapy[13]. Occupational therapy protocols for paediatric clients, including learners of school age were not included in the scope of this review and would require a focused separate review to render more age specific interventions.

CONCLUSION

This rapid review has provided a comprehensive overview of occupational therapy interventions for stroke survivors, drawing from level one and double peer-reviewed evidence published over the past five years. The diverse interventions reported shows the multifaceted nature of stroke recovery and the profession's commitment to addressing impairments and individual needs. However, analysis has highlighted critical research gaps on the role of occupational therapy in stroke rehabilitation with clients participate in post-school or higher learning environments, as well as in vocational rehabilitation and post-stroke return to work. Additionally, a lack of attention to occupational therapy's involvement in post-stroke driving rehabilitation was exposed. Moreover, the absence of specified settings within which post-stroke occupational therapy is offered raises questions about the applicability of evidence generated primarily from high-income countries to settings with different healthcare approaches and priorities.

Conflicts of interest and funding information

The authors have no conflict of interest to declare. The Occupational Therapy Association of South Africa (OTASA) requested the authors to do this rapid review and they were remunerated by the association.

Author contributions

All listed authors planned and participated in the review. Shaheed M Soeker initiated and supervised the review and Madri Engelbrecht led the construction of the article, and drafted it. Hester van Biljon, Janke van der Walt, and Shaheed M Soeker reviewed and contributed to the article in its various iterations.

REFERENCES

1. Kolapo, K.O. and Vento, S. Stroke: a realistic approach to a growing problem in sub-Saharan Africa is urgently needed. Tropical Medicine and International Health. 2011; 16(6): 707-710. https://doi.org/10.1111/j.1365-3156.2011.02759.x
2. The SASPI Project Team. Secondary prevention of stroke - results from the Southern Africa Stroke Prevention Initiative (SASPI) study. Bulletin of the World Health Organization. 2004; 82(7): 503-508
3. Govender, P., Naidoo, D., Bricknell, K., Ayob, Z., Message, H. and Njoko, S. 'No one prepared me to go home': Cerebrovascular accident survivors' experiences of community reintegration in a peri-urban context. Afr j Prm Health Care Fam Med. 2019; 11(1): a1806. https://doi.org/10.4102/phcfm.v11i1.1806
4. García-Pérez, P., Lara, J.P., Rodríguez-Martínez, M.C. and de la Cruz-Cosme, C. Interventions within the Scope of Occupational Therapy in the Hospital Discharge Process Post-Stroke: A Systematic Review. Healthcare. 2022; 10(9) 1645. https://doi.org/10.3390/healthcare10091645
5. South African Government. National Health Act 61 of 2003. South Africa; 2003; [Accessed 2023 Jun 10]. Available from: https://www.gov.za/sites/default/files/gcis_document/201409/a61-03.pdf.
6. National Department of Health. Framework and strategy for disability and rehabilitation services [homepage on the Internet]. 2015 [Accessed 2023 Jun 10]. Available from: http://ilifalabantwana.co.za/wp-content/uploads/2016/07/Framework-25-may_1_3.docx
7. South African Government. The Constitution of the Republic of South Africa. The Bill of Rights Republic of South Africa. [Accessed 2023 Jun 10]. Available from: https://www.gov.za/documents/constitution/chapter-2-bill-rights; 1996 p. 243.
8. National Department of Health. White Paper: National Health Insurance Policy - Towards Universal Health Coverage. Dep Heal. 2017;1–67.
9. OTASA. Occupational Therapy Association of South Africa: Where do occupational therapists work [Internet]. 2023. Available from: https://www.otasa.org.za/about-otasa/#:~:text=What is Occupational Therapy (OT,the activities of everyday life.
10. Garritty, C., Gartlehner, G., Kamel, C., King, V.J., Nussbaumer-Streit, B., Stevens, A. and Hamel, C.A.L. Cochrane Rapid Reviews. Interim Guidance from the Cochrane Rapid Reviews Methods Group. 2020.
11. South Africa Department of Health. Methods guide for rapid reviews for covid-19 medicine reviews. 2021
12. WFOT. WFOT Definition of Occupational Therapy [Internet]. 2012. Available from: https://wfot.org/resources/definitions-of-occupational-therapy-from-member-organisations
13. Breytenbach, F. and de Witt, P. Stroke rehabilitation standard operating protocol for occupational therapy. OTASA, Pretoria. 2023
14. Forrest, J.L, and Miller, S.A. (2009). Translating Evidence-Based decision making into practice: EBDM concepts and finding the evidence, Journal of Evidence Based Dental Practice, 9:59-72, https://doi.10.1016/j.jebdp.2009.03.017
15. Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffman, T.C., Mulrow, C.D. et al. The PRISMA guideline for reporting systematic reviews. BMJ. 2021; 372: n71. http://doi.org/10.1136/bmj.n71
16. Rayyan Sytems I. Rayyan Intelligent Systematic Review. Rayyan https://rayyan.qcri.org/. 2020.
17. Critical Appraisal Skills Programme. CASP Systematic Review [Internet]. 2018. Available from: http://creativecommons.org/licenses/by-nc-sa/3.0/ www.casp-uk.net
18. Villa-Berges, E., Soriano, A.A.L., Lucha-López, O., Tricas-Moreno, J., Hernández-Secorún, M., Gómez-Martínez, M. and Hidalgo-García, C. (2023). Motor imagery and mental practice in the subacute and chronic phases in upper limb rehabilitation after stroke: a systematic review, Occupational Therapy International, Volume 2023, Article ID 3752889, https://doi.org/10.1155/2023/3752889
19. De Souza, I.G., De Souza, R.F., Barbosa, F.D.S., Da Silva Scipioni, K.R.D., Aidar, F.J. and De Freitas Zanona, A. (2021). Protocols used by occupational therapists on shoulder pain after stroke: systematic review and meta-analysis, Occupational Therapy International Volume 2021, Article ID 8811721, https://doi.org/10.1155/2021/8811721
20. Kerr, L., Jewell, V.D., and Jensen, L. Stretching and splinting interventions for poststroke spasticity, hand function, and functional tasks: A systematic review. American Journal of Occupational Therapy. 2020; 74(5), https://doi.org/10.5014/ajot.2020.029454
21. Dorsch, S., Carling, C., Cao, Z., Fanayan, E., Graham, P.L., McCluskey, A., Schurr, K., Scrivener, K. and Tyson, S. (2023), Bobath therapy is inferior to task-specific training and not superior to other interventions in improving arm activity and arm strength outcomes after stroke: a systematic review, Journal of Physiotherapy, 69 (2023), 15-22, https://doi.org/10.1016/j.jphys.2022.11.008
22. Nogueira, N.G.H.M, Parma, J.O., Leão, S.E.S.A, Sales, I.S., Macedo, L.C., Galvão, A.C.D.R., De Oliveira, D.C., Murça, T.M., Fernandes, L.A., Junqueira, C., Lage, G.M. and Ferreira, B.P. (2021) Mirror therapy in upper limb motor recovery and activities of daily living and its neural correlates in stroke individuals: a systematic review and

meta-analysis, Brain Research Bulletin, 177 (2021) 217-238, https://doi.org/10.1016/j.brainresbull.2021.10.003
23. Zhang, B., Kan, L., Dong, A., Zhang, J., Bai, Z., Xie Y., Liu, Q. and Peng, Y. (2019) The effects of action observatin training on improving upper limb motor functions in people with stroke: a systematic review and meta-analysis. PLoS ONE, 14(8): e0221166, https://doi.org/10.1371/journal.pone.0221166.
24. Turville, M.L., Cahill, L.S., Matyas, T.A., Blnnerhassett, J.M. and Carey, L.M. (2019). The effectiveness of somatosensory retraining for improving sensory function in the arm following stroke: a systematic review, Clinical Rehabilitation 2019, 33(5) 834-846, https://doi.org/10.1177/0269215519829795
25. Barclay, R.E., Stevenson, T.J., Poluha, W., Semenko, B., Schubert, J. Mental practice for treating upper extermity deficits in individuals with hemiparesis after stroke. Cochrane Database of Systematic Reviews 2020, Issue 5. Art. No.: CD005950. https://doi.org/10.1002/14651858.CD005950.pub5.
26. Bai, Z., Fong, K.N.K., Zhang, J.J., Chan, J. and Ting, K.H. (2020) Immediate and long-term effects of BCI-based rehabilitatin of the upper extermity after stroke: a systematic review and meta-analysis, Journal of NeuroEngineering and Rehabilitation, (2020) 17:57, https://doi.org/10.1186/s12984-020-00686-2
27. Mohammadi, R., Semnani, A.V., Mirmohammadkhani, M. and Grampurohit, N. (2019). Effects of virtual reality compared to conventional therapy on balance poststroke: a systematic review and meta-analysis, Journal of Stroke and Cerebrovascular Diseases, 28(7), 1787-1798, https://doi.org/10.1016/j.jstrokecerebrovasdis.2019.03.054
28. Green, E., Huynh, A., Broussard, L., Zunker, B., Matthews, J., Hilton, C.L. and Aranha, K. (2019). Systematic review of yoga and balance: effect on adults with neuromuscular impairment, American Journal of Occupational Therapy, 2019 Jan 1; 73(1), https://doi.org/10.5014/ajot.2019.028944
29. Mack, A. and Hildebrand, M. (2023). Interventions for caregivers of people who have had a stroke: a systematic review, American Journal of Occupational Therapy, 77, 7701205180, https://doi.org/10.5014/ajot.2023.050012
30. Gibson, E., Koh, C.L., Eames, S., Bennett, S., Scott, A.M. and Hoffmann, T.C. (2022). Occupational therapy for cognitive impairment in stroke patients, Cochrane Database of Systematic Reviews 2022, Issue 3. Art. No.: CD006420, https://doi.org/10.1002/14651858.CD006430.pub3
31. Chen, X., Liu, F., Lin, S., Yu, L. and Lin, R. (2022). Effects of virtual reality rehabilitation training on cognitive function and activities of daily living of patients with poststrok cognitive impairment: a systematic review and meta-analysis, Archives of Physical Medicine and Rehabilitation, 103(7):1422-35, https://doi.org/10.1016/j.apmr.2022.03.012
32. Nie, P., Liu, F., Lin, S., Guo, J., Chen, X., Chen, S., Yu, L, and Lin, R. (2021). The effects of computer-assisted cognitive rehabilitation on cognitive impairment after stroke: a systematic review and meta-analysis, Journal of Clinical Nursing, 31(9-10):1136-1148, https://doi.org/10.1111/jocn.16030
33. Proffitt, R., Boone, A., Hunter, E.G., Schaffer, O., Strickland, M., Wood, L. and Wolf, T.J. (2022). Interventions to improve social participation, work and leisure among adults poststroke: a systematic review, American Journal of Occupational Therapy, 76(5), 7605205120, https://doi.org/10.5014/ajot.2022.049305
34. Lee, D., Heffron, J.L. and Mirza, M. (2019). Content and effectiveness of interventions focusing on community participation poststroke: a systematic review, Archives of Physical Medicine and Rehabilitation, 100 (11):2179-92, https://doi.org/10.1016/j.apmr.2019.06.008
35. Stewart, C., Subbarayan, S., Paton, P., Gemmell, E., Abraha, I., Myint, P.K., O'Mahony, D., Cruz-Jentoft, A.J., Cherubini, A. and Soiza, R.L. (2018). Non-pharmacological interventions for the improvement of post-stroke activities of daily living and disability amongst older stroke survivors: a systematic review, PLoS ONE, 13(10):e0204774, https://doi.org/10.1371/journal.pone.0204774
36. Safro, F.S., Ulsavets, U., Opare-Sem, O.K. and Ovbiagele, B. (2018), Tele-rehabilitation after stroke: an updated systematic review of the literature, Journal of Stroke and Cerebrovascular Diseases, 27(9):2306-2318, https://doi.org/10.1016/j.jstrokecerebrovasdis.2018.05.013
37. Rodríguez-Martínez, C., Maestre, A.P., Armenta-Peinado, J.A., Barbancho, M.A. and García-Casares, N. (2021), Evidence of animal-assisted therapy in neurological diseases in adults: a systematic review, International Journal of Environment Research and Public Health, 18(24), 12882, https://doi.org/10.3390/ijerph182412882
38. McGlinchey, M.P., James, J., McKevitt, C., Douiri, A. and Sackley, C. (2020). The effect of rehabilitation interventions on physical function and immobility-related complications in severe stroke: a systematic review, British Medical Journal Open, 10(2):e033642, https://doi.org/10.1136/bmjopen-2019-033642.
39. Díaz-Arribas, M.J., Martín-Casas, P., Cano-de-la-Cuerda, R. and Plaza-Manzano, G. (2020). Effectiveness of the Bobath concept in the treatment of stroke: a systematic review, Disability and Rehabilitation, 42:12, 1636-1649, https://doi.org/10.1080/09638288.2019.1590865
40. Peng, T-H., Zhu, J-D., Chen, C-C., Tai, R-Y., Lee, C-Y. and Hsieh, Y.W. (2019). Action observation therapy for improving arm function, walking ability, and daily activity performance after stroke: a systematic review and meta-analysis, Clinical Rehabilitation, 33(8) 1277-1285, https://doi.org/10.1177/0269215519839108
41. Khan, F., Amatya, B., Bensmail, D. and Yelnik, A. (2019). Non-pharmacological interventions for spasticity in adults: an overview of systematic reviews, Annals of Physical and Rehabilitation Medicine, 62(2019) 265-273, https://doi.org/10.1016/j.rehab.2017.10.001